CLAIMS

We claim:

1. A powersplit hybrid electric vehicle (HEV) powertrain, comprising:

an engine;

a traction motor;

a generator motor;

an electric energy storage device for storing electric energy, the electric energy storage device connected to the traction motor to power the traction motor, and the electric energy storage device connected to the generator motor to receive energy generated by the generator motor;

a power transmission device having at least one forward drive position to move the HEV in a forward direction and at least one reverse drive position to move the HEV in a reverse direction, the power transmission device being connected to the engine, the traction motor, and the generator motor; and

a driver operated drive position selector comprising a reverse drive mode; and

a vehicle system controller comprising a reverse drive mode controller activated when the drive position selector is in the reverse drive mode, the reverse drive mode controller preventing the electric energy storage

device state-of-charge (SOC) from continuously falling while meeting driver demand.

2. The powertrain of claim 1 wherein the reverse drive mode controller comprises:

a determination of whether the engine and generator motor are running;

a calculation of a benefit power from the engine if the engine and the generator motor are running;

a comparison of the benefit power with a first predetermined value;

a determination of whether a driver torque request plus the traction motor torque is greater than a predetermined maximum traction motor torque if the benefit power is greater than or equal to the first predetermined value;

a calculation of new generator motor torque request if the determination of whether the driver torque request plus the generator motor torque is greater than the predetermined maximum torque;

a determination of whether the new generator motor torque request is greater than or equal to a second predetermined value;

a calculation of a new generator motor speed for the new generator motor torque request if the new generator motor torque request is greater than or equal to the second predetermined value;

a determination of whether the new generator motor speed is less than or equal to a maximum generator motor speed; and

a determination of a new generator motor torque request if the new generator motor speed is less than or equal to the maximum generator motor speed.

3. The powertrain of claim 2 wherein the benefit power from the engine is determined by the equation:

$\eta_g \tau_e \omega_e - (1/\eta_m - \eta_g)\tau_r \omega_r$.

4. The powertrain of claim 2 wherein the calculation of the new generator motor torque request is determined by the equation:

$\tau_{g\_req} = (\tau_{m\_max} - \tau_{d\_req@m})/T$.

5. The powertrain of claim 2 wherein the new traction motor torque request is determined by adding the driver torque request to the new generator motor torque request.

6. The powertrain of claim 2 wherein the reverse drive mode controller further comprises a stop engine command if the benefit power is less than the first predetermined value.

7. The powertrain of claim 2 wherein the reverse drive mode controller further comprises a stop engine command if the new generator motor torque request is less than the second predetermined value.

8. The powertrain of claim 2 wherein the reverse drive mode controller further comprises a stop engine command if the new generator motor speed is greater than a maximum generator motor speed.

9. A method to control reverse drive mode in a hybrid electric vehicle (HEV) when a drive position selector is in a reverse drive mode to prevent an electric energy storage device state-of-charge (SOC) from continuously falling while meeting driver demand, comprising the steps of:

determining whether an engine and generator motor are running;

calculating a benefit power from the engine if the engine and the generator motor are running;

comparing the benefit power with a first predetermined value;

determining whether a driver torque request plus generator motor torque is greater than a predetermined

maximum traction motor torque if the benefit power is greater than or equal to the first predetermined value;

calculating a new generator motor torque request if the step of determining whether the driver torque request plus the generator motor torque is greater than the predetermined maximum traction motor torque;

determining whether the new generator motor torque request is greater than or equal to a second predetermined value;

calculating a new generator motor speed for the new generator motor torque request if the new generator motor torque request is greater than or equal to the second predetermined value;

determining whether the new generator motor speed is less than or equal to a maximum generator motor speed; and

determining a new traction motor torque request if the new generator motor speed is less than or equal to the maximum generator motor speed.

10. The method of claim 9 wherein the step of determining the benefit power from the engine uses the equation:

$\eta_g \tau_e \omega_e - (1/\eta_m - \eta_g)\tau_r \omega_r$.

11. The method of claim 9 wherein the calculation of the new generator motor torque request is determined by the equation:

$\tau_{g\_req} = (\tau_{m\_max} - \tau_{d\_req@m})/T.$

12. The method of claim 9 wherein the step of determining the new traction motor torque request is achieved by adding the driver torque request to the new generator motor torque request.

13. The method of claim 9 further comprising the step of stopping the engine if the benefit power is less than the first predetermined value.

14. The method of claim 9 further comprising the step of stopping the engine if the new generator motor torque request is less than the second predetermined value.

15. The method of claim 9 further comprising the step of stopping the engine if the new generator motor speed is greater than the maximum generator motor speed.